Attorney Docket No.: OGOSH40USA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application No.	:	10/551,732	Confirmation No. 4329
Applicant	:	Kunihiro Oda et al.	
371 Filed	:	October 3, 2005	
Art Unit	:	1793	
Examiner	:	Caitlin Anne Fogarty	
Customer No.	:	00270	
Title	:	TANTALUM SPUTTERING TARGET AND METHOD OF MANUFACURING SAME	

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APPEAL BRIEF

Sir:

This is an Appeal Brief submitted in accordance with 37 CFR §41.37 within two months from the filing of May 28, 2010 of a Notice of Appeal. The appeal is taken from a FINAL rejection issued on March 3, 2010 for the above identified application.

Real Party in Interest

The real party in interest is Nippon Mining & Metals Co., Ltd. (via assignment from both named inventors to Nikko Materials Co., Ltd. recorded in the U.S. Patent and Trademark Office on December 4, 2006, reel/frame: 018578/0886, and via name change to Nippon Mining & Metals Co., Ltd. recorded in the U.S. Patent and Trademark Office on December 8, 2006, reel/frame: 018605/0969).

Related Appeals and Interferences

There are no known prior or pending related appeals, interferences or judicial proceedings.

Status of Claims

Claims 1-3, 7, 8, 13-27 and 29-31 are rejected.

Claims 4-6, 9-12 and 28 are canceled.

Appellant appeals the final rejection of claims 1-3, 7, 8, 13-27 and 29-31.

Status of Amendments

No amendment has been filed by the Appellant or entered by the Examiner in the above referenced application since the Final Office Action dated March 3, 2010.

Summary of Claimed Subject Matter

Independent claim 1 is directed to a tantalum sputtering target manufactured by subjecting a molten and cast tantalum ingot or billet to plastic working such as forging, annealing and rolling. See page 6, lines 19-24, of the present application, as filed. Independent claim 1 requires that the tantalum sputtering target have a non-recrystallized structure. With respect to a disclosure and explanation of a non-recrystallized structure, see: page 7, lines 9-10; page 8, lines 4-11; page 9, lines 5-12 and 19-26; page 10, lines 26-27; page 11, lines 5-9; page 12, Table 1, row titled "Non-crystallized %" ; page 13, lines 20-21; page 15, lines 1-2; page 16, lines 10-11; page 17, lines 19-20; page 19, lines 1-2; and page 23, last line, to page 24, line 3.

Independent claim 7 is directed to a method of manufacturing a tantalum sputtering target comprising the steps of subjecting a molten and cast tantalum ingot or billet to forging, annealing and rolling processes, and performing plastic working on said ingot or billet to provide the tantalum sputtering target with a non-recrystallized structure. See: page 10, lines 8-27, for Example 1; page 13, lines 2-21, for Example 2; page 14, line 12, to page 15, line 2, for Example 3; page 15, line 21, to page 16, line 11, for Example 4; page 17, lines 2-20, for Example 5; and page 18, line 11, to page 19, line 2, for Example 6.

Independent claim 8 is directed to a method of manufacturing a tantalum sputtering target comprising the steps of subjecting a molten and cast tantalum ingot or billet made of a tantalum raw material having a purity of 4N5 (99.995%) or more to forging, annealing and rolling, performing a plastic working process on the ingot or billet, and thereafter annealing the ingot or billet at a temperature of 1173K or less to provide the tantalum sputtering target with a non-recrystallized structure. See: page 6, lines 20-21; page 7, line 26, to page 8, line 5; page 10, lines

8-27, for Example 1; page 13, lines 2-21, for Example 2; page 14, line 12, to page 15, line 2, for Example 3; and page 15, line 21, to page 16, line 11, for Example 4.

None of the claims includes a means-plus or step-plus function permitted by 35 USC §112, sixth paragraph.

Grounds of Rejection to be Reviewed on Appeal

Claims 1-3, 7, 8, 13-27 and 29-31 stand rejected under 35 USC §103(a) as being obvious over U.S. Patent Application Publication No. 2001/0054457 A1 of Segal et al. (hereinafter referred to as "Segal et al.").

Argument

I. §103(a) Rejection of Claim 1

Claim 1 of the present application requires a tantalum sputtering target having a non-recrystallized structure.

As best stated on page 1, lines 25-28, of the present application, as filed, it is conventional practice to subject a tantalum billet or ingot to annealing so that a recrystallized structure is provided. Also, see page 3, lines 7-13, of the present application, as filed, with respect to conventional efforts to make the recrystallized structure fine and more uniform.

The present invention is directed opposite to that of conventional fully-recrystallized tantalum sputtering targets. Thus, the tantalum sputtering target claimed in the present application is required to be non-recrystallized.

The mechanism of recrystallization is described in the present application, as filed, on page 3, line 14, to page 4, line 2, as follows:

> "When observing the mechanism of recrystallization, generally speaking, a recrystallized structure is an aggregate of individual crystals with respectively different plane orientations, and each crystal is divided by a grain boundary. Before rearrangement occurs, the strain added to the object via plastic working such as cold rolling is absorbed in the primary crystals by the transgranular slip in a certain direction, and the strain is accumulated therein.
>
> Such strained primary crystals take on a network cell structure that is extremely fine with slightly different orientations aggregated with lattice defects such as transition, and are also separated into a plurality of different areas with significantly differing orientations. When this kind of deformation structure is heated, the cells change into subgrains (recovery process) through the combination of transition or rearrangement. The change from a cell into a subgrain hardly involves any change in the measurement. And, it is considered that these subgrains are combined, and a specific subgrain grows to become a recrystallized core, corrodes the non-recrystallized portion, grows and promotes the recrystallization.
>
> As described above, with a tantalum target, it is said that a fully recrystallized structure based on full annealing is favorable in stabilizing the structure."

In contrast to a fully recrystallized structure as directed by conventional teachings, the present invention requires the tantalum target to having a non-recrystallized structure. This structure is explained in the present application, as follows:

> "... what is especially important in the present invention is to obtain a target material ultimately subject to plastic working such as cold rolling, or to refrain from conducting sufficient recrystallization so as to leave the processed structure after the final processing step" (page 7, lines 8-10, of the present application, as filed);

> "In the present invention, it is desirable to obtain a material ultimately subject to plastic working such as cold rolling as described above, or to perform annealing at a temperature of 1173 K or less after the final plastic working process such as rolling. When performing such annealing, there is an effect of alleviating the warping or deformation of the target. This is thereafter subject to finish processing (machining or the like) so as to form a target shape.

The structure obtained thereby is a non-recrystallized structure, and a processed structure remains therein" (page 7, line 26, to page 8, line 5, of the present application, as filed);

"Although recrystallization will not occur under the foregoing temperature conditions for annealing, it is considered that the structure during the stage midway to recrystallization; that is, during the subgrain (recovery process) stage, occurs due to the heat from the annealing performed at roughly 1073 K.

With these subgrains, the strain added to the object is absorbed in the primary crystals by the transgranular slip in a certain direction, the strain is accumulated therein, and the subgrains have a structure before the crystal growth separated into different regions in slightly different directions divided with a plurality of transitions in this strained primary crystal" (page 8, lines 12-20, of the present application, as filed);

"What is most important in the present invention is not to perform sufficient recrystallization after the final process, but to yield an effect of improving the uniformity merely by leaving the processed structure therein" (page 9, lines 10-12, of the present application, as filed);

"The tantalum sputtering target of the present invention has a characteristic non-recrystallized structure obtained from the foregoing manufacturing process" (page 9, lines 25-26, of the present application, as filed); and

"The non-recrystallized structure referred to in this Description is a structure in which the grain boundary is unclear, or a structure where the grain boundary is twisting in a curved line, or both, as represented in FIG. 1 and FIG. 2, and the percentage (%) is defined by subtracting the area ratio of the obvious recrystallized portion as represented in FIG. 3 and FIG. 4 from 100%" (page 11, lines 5-9, of the present application, as filed).

Accordingly, Appellant respectfully submits that there is a significant and patentable difference between a finished sputtering target having a recrystallized structure according to conventional teachings and a finished sputtering target having a non-recrystallized structure required by claim 1 of the present application. As will be discussed in greater detail below, the teachings of Segal et al. are consistent with conventional teachings with respect to recrystallization and thus teach-away from the claimed invention.

Before turning to Segal et al., Appellant respectfully submits that there are several errors in the reasoning provided in the FINAL Office Action with respect to the obviousness rejection of claim 1. The following is stated in the FINAL Office Action:

> "Although Segal teaches that the final product is recrystallized, the Examiner takes the position that it would have been obvious to one of ordinary skill in the art to stop the method of Segal after the intermediate step in order to obtain a tantalum sputtering target with a non-recrystallized structure <u>if the desired use of the tantalum sputtering target is to obtain a film with a non-recrystallized structure</u>. It is well known in the art that a thin film deposition formed by the bombardment of the sputtering target with energetic particles <u>has the same microstructure as that of the sputtering target</u>." [Emphasis added]

While Segal et al. teach an intermediate annealing step between the extrusion pass processes, Segal et al. clearly teach that the extrusion pass process is performed under conditions where dynamic recrystallization will occur. Thus, there is simply no fair or common sense teaching or motivation provided by Segal et al. with respect to a finished sputtering target product having a non-recrystallized structure.

Further, in a sputtering process, components of the target are extracted in atomic units and deposited on a substrate to from a thin film. It is correct that the chemical composition of the thin film is essentially the same as the target. However, the metal structure of the target is never maintained in the thin film. Thus, it is an error to conclude that the thin film will have the same microstructure as the sputtering target, and it is not true that a sputtering target having a non-recrystallized structure would be used if the desired use of the tantalum sputtering target is to obtain a film with a non-recrystallized structure.

A further error is stated in the FINAL Office Action where it is concluded that the sputtering target of Segal et al. is made "using a method similar to that of the present invention".

Segal et al. clearly disclose use of an "equal channel angular extrusion" process which is different from forging and rolling techniques. Thus, the respective methods are neither the same nor similar.

Turning to Segal et al., it discloses a method of manufacturing a sputtering target with an application of "equal channel angular extrusion". For example, see the Abstract, FIG. 11, and Paragraph No. 0003 of the Segal et al. application publication.

Equal channel angular extrusion (ECAE) is an extrusion process in which a workpiece is extruded around a corner without reduction of the cross-sectional area of the deformed workpiece. For example, a square cross-section bar of metal is forced through a channel across a 90° angle corner. The cross-section of the channel is equal on entry and exit of the 90° angle corner. This is unlike conventional deformation processes such as rolling and forging in which strain is introduced by a reduction in cross-section of the metal workpiece. Thus, the disclosed process of Segal et al. is not the same nor is it similar to that required by the present invention.

Further, Segal et al. clearly require equal channel angular extrusion to be accomplished under conditions that "provide dynamic recrystallization during ECAE". See Paragraph Nos. 0051, 0052, 0058, 0071, and 0074 of the Segal et al. application publication. Further, see references to: a "fine and uniform structure" in Paragraph No. 0002; "grain size less than about 1μm" in Paragraph Nos. 0004 and 0035 and Claim 1; the "present invention provides a method for fabricating precipitate-free and ultra-fine grain targets" in Paragraph No. 0047; the "invention further contemplates the fabrication of targets with fine and uniform grain structure" in Paragraph No. 0051; a "method for fabricating fine and stable grain structures" and the "billet after ECAE with dynamically recrystallized sub-micron structure" in Paragraph No. 0052; after

"intermediate annealing EACE is repeated with the number of passes necessary to develop a dynamically recrystallized structure with the desired fine and equiaxed grains" in Paragraph No. 0058; and "a mechanism termed dynamic recrystallization occurs and promotes the creation of sub-micron grains in the structure" in Paragraph No. 0071 of the Segal et al. publication.

Accordingly, Segal et al. is consistent with conventional teachings which direct one of ordinary skill in the art to provide finished tantalum sputtering target products with a recrystallized structure (i.e., Segal et al. require ECAE to be performed under conditions that provide dynamic recrystallization) having a fine and uniform grain structure. Thus, Segal et al. teach to one of ordinary skill in the art the application of equal channel angular extrusion (ECAE) (i.e. see apparatus for performing ECAE in FIGs. 11, 11A and 11B) and that ECAE is required to be conducted under conditions where "dynamic recrystallization" occurs to produce a finished target with a fine and uniform grain structure. Thus, one of ordinary skill in the art is aware that the sputtering target prepared according to Segal et al. has a recrystallized structure (with fine and uniform grains of less than 1μm). Accordingly, Segal et al. certainly fail to disclose a sputtering target with a non-recrystallized structure as required by claim 1 and all pending claims of the present application.

"Teaching away" is the antithesis of the art suggesting that the person of ordinary skill in the art go in the claimed direction. Essentially, "teaching away" is a per se demonstration of lack of obviousness. Here, Segal et al. clearly teach-away from a tantalum sputtering target having a non-recrystallized structure. For this reason, Appellant respectfully submits that the rejection of claim 1 as being obvious over Segal et al. is in error and should be reversed.

In the FINAL Office Action, it is readily acknowledged that Segal et al. fails to disclose a tantalum sputtering target having a non-recrystallized structure. However, the rejection is still applied based on the following reasoning:

> "Although Segal teaches that the final product is recrystallized, the Examiner takes the position that it would have been obvious to one of ordinary skill in the art to <u>stop the method of Segal after the intermediate step</u> in order to obtain a tantalum sputtering target with a non-recrystallized structure <u>if the desired use of the tantalum sputtering target is to obtain a film with a non-recrystallized structure</u>. It is well known in the art that a thin film deposition formed by the bombardment of the sputtering target with energetic particles has the same microstructure as that of the sputtering target." [Emphasis added]

Appellant respectfully submits that this basis for rejection should be reversed for several reasons. Segal et al. teach inclusion of an intermediate annealing process between ECAE extrusion passes. However, Segal et al. is clear in stating that the ECAE process is performed under conditions of dynamic recrystallization to produce a target having a fine and uniform grain structure. Accordingly, Appellant respectfully submits that there is no common sense motivation provided by the teachings of Segal et al. to provide a sputtering target having a non-recrystallized structure. Thus, stopping the method of Segal et al. after intermediate step extrusion passes would not be obvious or consistent with the clear teachings of Segal et al. to perform ECAE under conditions of dynamic recrystallization and to provide a target with fine and uniform grain size.

Further, the reasoning of "if the desired use of the tantalum sputtering target is to obtain a film with a non-recrystallized structure" is in error. There is no correlation with respect to the microstructure of the thin film relative to that of the sputtering target. The chemical composition will essentially be the same, not the microstructure. In fact, the tantalum sputtering target with a

non-recrystallized structure according to the present application is for use in forming the same complex thin films as that formed by a target having a recrystallized structure. As best stated on page 4, lines 14-18, of the present application, as filed, Appellant submits that the sputtering target of the present invention provides higher deposition speed, excellent uniformity of film, produces less unwanted arcings and particles during sputtering, has excellent film forming properties, and can be stably manufactured in commercial sized quantities. The same thin films formed by recrystallized sputtering targets are formed by the sputtering target according to the present invention, except the present invention provides the above advantages which are unexpected results in terms of conventional teachings with respect to making conventional recrystallized tantalum target structures fine and more uniform.

Accordingly, the reasoning on which the obviousness rejection is based is faulty. One of ordinary skill in the art would recognize that the assumption that a non-recrystallized target is needed for producing a particular microstructure of a thin film is incorrect. The structure of the target is simply not maintained in the film which is formed when atomic units of the target are extracted and deposited on a substrate to form the thin film. For this additional reason, Appellant respectfully submits that the rejection of claim 1 as being obvious over Segal et al. is in error and should be reversed.

II. §103(a) Rejection of Claims 2 and 3

Claims 2 and 3 depend from base independent claim 1. Accordingly, claims 2 and 3 are submitted as being patentable and non-obvious over Segal et al. for the same reasons that claim 1 is submitted as being patentable over the Segal et al. application publication.

Claims 2 and 3 provided additional limitations with respect to the non-recrystallized structure which Segal et al. clearly does not teach, disclose, suggest or render obvious. Thus, claims 2 and 3 further distance the claimed invention from the disclosure of the Segal et al. application publication. Appellant respectfully submits that the rejection of claims 2 and 3 is improper and should be reversed and withdrawn.

III. §103(a) Rejection of Claim 13-16 and 31

Claims 13-16 and 31 depend from base independent claim 1. Accordingly, claims 13-16 and 31 are submitted as being patentable and non-obvious over Segal et al. for the same reasons that claim 1 is submitted as being patentable over the Segal et al. application publication.

Claims 13-16 and 31 recite additional structural limitations with respect to a tantalum sputtering target. Claims 13-16 are directed to a stated Vickers hardness of the tantalum sputtering target and claim 31 requires 99.995% by weight of the sputtering target to be tantalum.

Appellant acknowledges that "Ta" is listed in a long list of metals that might be contained in some amount in a target. See Paragraph Nos. 0002 and 0004 and claim 2 of the Segal et al. application publication. Thus, at best, Segal et al. provides a disclosure of using an ECAE process under the conditions of providing dynamic recrystallization for a target comprising some amount of tantalum. However, as disclosed in claims 1 and 2 published by Segal et al., the target would have a fine and uniform grain size of less than about 1μm (i.e., be a fully recrystallized structure).

The overwhelming bulk of the disclosure provided by Segal et al. is directed to a specific aluminum alloy containing 0.5wt% of copper. See the description of FIGs. 2 and 4-9 of the

Segal et al. application publication. Specific information concerning a target containing some amount of tantalum is not provided. Appellant respectfully submits that Ta has considerably different crystal structures, mechanical properties, and plastic deformation properties in comparison to the Al-5wt% Cu alloy disclosed and described in detail by the Segal et al. application publication. Thus, the examples of the Al-5wt% Cu alloy do not demonstrate that the same effects of the invention of Segal et al. can also be yielded with a sputtering target made of Ta or made, for instance, with Ta of 99.995% purity or greater. Also, the method of manufacture of the targets of Segal et al. is different from the present invention for reasons discussed above. Accordingly, there would be no reasonable expectation by one of ordinary skill in the art that the properties of a tantalum target of Segal et al. (produced by ECAE processes under conditions of dynamic recrystallization) would be the same as that required by claims 13-16 and 31 of the present application.

Further, hardness, in particular, is a material property that is very sensitive and dependent on the metal structure of a workpiece. As discussed above, the metal structure of the present invention and the metal structure of the targets of Segal et al. would be different because different manufacturing processes are used. Segal et al. use ECAE under conditions of dynamic recrystallization to produce a target with a fine grain size. The present invention uses forging/rolling and leaves a processed structure providing a non-recrystallized structure. Since hardness of tantalum varies greatly based on metal structure, it would not be expected by one of ordinary skill in the art that these differently produced targets would have similar values of Vickers hardness.

Accordingly, Appellant respectfully submits that Segal et al. fails to disclose or obviate the limitations of claims 13-16 and 31 of the present application. Appellant respectfully requests that the rejection of claims 13-16 and 31 be reversed.

IV. §103(a) Rejection of Claims 7 and 17-20

Claim 7 requires a process step of providing the sputtering target with a non-recrystallized structure.

Segal et al. fails to teach or obviate the step of making a non-recrystallized structure. The same arguments provided above for claim 1 of the present application being patentable over Segal et al. equally apply to method claim 7 of the present application. Accordingly, claims 7 and 17-20 are submitted as being patentable and non-obvious over the Segal et al. application publication. Appellant respectfully submits that the rejection of claims 7 and 17-20 should be reversed.

V. §103(a) Rejection of Claims 8, 21-27, 29 and 30

Claim 8 includes the limitations recited in claim 7 and further requires the tantalum raw material to have a purity of 4N5 (99.995%) or more and further requires the step of annealing the ingot or billet after plastic working at a temperature of 1173K or less to provide the tantalum sputtering target with a non-recrystallized structure.

Segal et al. fails to teach or obviate the step of making a non-recrystallized structure. The same arguments provided above for claim 1 of the present application being patentable over Segal et al. equally apply to claim 8 of the present application. Accordingly, claims 8, 21-27, 29

and 30 are submitted as being patentable and non-obvious over the Segal et al. application publication. Appellant respectfully submits that the rejection of claims 8, 21-27, 29 and 30 should be reversed.

Summary

For the reasons stated above, it is submitted that the final rejection of claims 1-3, 7, 8, 13-27 and 29-31 should be reversed.

Payment of $540 for the required fee under 37 CFR §41.20(b)(2) is charged to our deposit account No. 08-3040. Please charge any deficiency in the fee submitted for this brief to our deposit account 08-3040.

Respectfully submitted,
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Enclosures:
(a) appendix with copy of claims on appeal

CLAIMS APPENDIX

COPY OF CLAIMS INVOLVED IN THE APPEAL

Claim 1 (previously presented): A tantalum sputtering target manufactured by subjecting a molten and cast tantalum ingot or billet to plastic working such as forging, annealing and rolling, said tantalum sputtering target having a non-recrystallized structure.

Claim 2 (original): A tantalum sputtering target according to claim 1, wherein the non-recrystallized structure is 20% or more.

Claim 3 (original): A tantalum sputtering target according to claim 1, wherein the non-recrystallized structure is 40% or more.

Claims 4-6 (canceled).

Claim 7 (previously presented): A method of manufacturing a tantalum sputtering target comprising the steps of subjecting a molten and cast tantalum ingot or billet to forging, annealing and rolling processes, and performing plastic working on said ingot or billet to provide the tantalum sputtering target with a non-recrystallized structure.

Claim 8 (previously presented): A method of manufacturing a tantalum sputtering target comprising the steps of subjecting a molten and cast tantalum ingot or billet made of a tantalum raw material having a purity of 4N5 (99.995%) or more to forging, annealing and rolling,

performing a plastic working process on the ingot or billet, and thereafter annealing the ingot or billet at a temperature of 1173K or less to provide the tantalum sputtering target with a non-recrystallized structure.

Claims 9-12 (canceled).

Claim 13 (previously presented): A tantalum sputtering target according to claim 3, wherein said tantalum sputtering target has a Vickers hardness of 90 or more.

Claim 14 (previously presented): A tantalum sputtering target according to claim 1, wherein said tantalum sputtering target has a Vickers hardness of 90 or more.

Claim 15 (previously presented): A tantalum sputtering target according to claim 1, wherein said tantalum sputtering target has a Vickers hardness of 100 or more.

Claim 16 (previously presented): A tantalum sputtering target according to claim 1, wherein said tantalum sputtering target has a Vickers hardness of 125 or more.

Claim 17 (previously presented): The method according to claim 7, wherein, after said plastic working, said ingot or billet is subjected to finish processing to form a target shape.

Claim 18 (previously presented): The method according to claim 7, wherein said annealing is recrystallization annealing, and wherein said forging and recrystallization annealing processes are repeated two or more times.

Claim 19 (previously presented): The method according to claim 7, wherein extend forging and upset forging are repeatedly performed on the ingot or billet.

Claim 20 (previously presented): The method according to claim 7, wherein said annealing is recrystallization annealing, and wherein said recrystallization annealing is performed at a temperature of between a recrystallization temperature of the ingot or billet and 1673K.

Claim 21 (previously presented): The method according to claim 8, wherein, after said plastic working process or after said step of annealing at 1173K or less, said ingot or billet is subjected to finish processing to form a target shape.

Claim 22 (previously presented): The method according to claim 21, wherein during said step of subjecting the molten and cast tantalum ingot or billet to forging, annealing and rolling, said annealing is recrystallization annealing, and said forging and recrystallization annealing processes are repeated two or more times.

Claim 23 (previously presented): The method according to claim 22, wherein extend forging and upset forging are repeatedly performed on the ingot or billet.

Claim 24 (previously presented): The method according to claim 23, wherein said recrystallization annealing is performed at a temperature of between a recrystallization temperature of the ingot or billet and 1673K.

Claim 25 (previously presented): The method according to claim 8, wherein during said step of subjecting the molten and cast tantalum ingot or billet to forging, annealing and rolling, said annealing is recrystallization annealing, and said forging and recrystallization annealing processes are repeated two or more times.

Claim 26 (previously presented): The method according to claim 8, wherein extend forging and upset forging are repeatedly performed on the ingot or billet.

Claim 27 (previously presented): The method according to claim 8, wherein during said step of subjecting the molten and cast tantalum ingot or billet to forging, annealing and rolling, said annealing is recrystallization annealing performed at a temperature of between a recrystallization temperature of the ingot or billet and 1673K.

Claim 28 (canceled).

Claim 29 (previously presented): The method according to claim 8, wherein said temperature is selected from the group consisting of 973K, 1048K, and 1073K.

Claim 30 (previously presented): The method according to claim 8, wherein said temperature is 973K to 1073K.

Claim 31 (previously presented): A tantalum sputtering target according to claim 1, wherein said tantalum sputtering target is made of high purity tantalum having a purity of 4N5 (99.995%) or more.

EVIDENCE APPENDIX - none

RELATED PROCEEDING APPENDIX - none